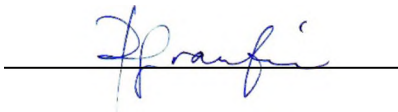


**STATE OF MINNESOTA DISTRICT COURT FOR THE
COUNTY OF HENNEPIN FOURTH JUDICIAL DISTRICT**

CIVIL ACTION NO. 27-CV-10-28862

STATE OF MINNESOTA, *et al.* v. 3M COMPANY

**EXPERT REPORT OF
PHILIPPE GRANDJEAN, MD, DMSc**



**PREPARED ON BEHALF OF
PLAINTIFF STATE OF MINNESOTA**

22 September, 2017

calculations, the MDH has issued fish consumption advice for bluegill, carp, largemouth bass, northern smallmouth bass, walleye, and white bass from Mississippi pool 2 and for some species also for the Minneapolis chain of lakes [18, 24].

2. Breast milk

Recent data support that U.S. children have higher serum concentrations than adults [25, 26]. As a potential contributor, evidence has accumulated that PFCs are excreted in human milk [27]. Analyses of paired samples of maternal serum, cord serum, and maternal milk have demonstrated that PFCs are transferred through the human placenta and via human milk [28, 29]. During prolonged breast-feeding, the cumulated postnatal exposure to PFCs through lactation can be much higher compared to prenatal exposure, especially for PFOA [29], thereby causing additional exposures during sensitive early development. From serial blood samples in young children, a recent study showed that extended breastfeeding could increase an infant's blood concentrations of PFCs to several-fold above the mother's [30].

These observations are in accord with a 3M-sponsored study on EtFOSE and FC-95 (PFOS) carried out in goats, as indicated by an email to Dr. Larry Zobel in early 1998.¹⁸ The first studies on transfer into milk were apparently carried out in 1993, as a document from that time states: "There is some preliminary evidence that in lactating goats PFOS is transferred to milk. It is likely that lactating human females would also transfer PFOS to milk."¹⁹ Again, it appears that 3M decided not to publish the results of this study, and it further appears that 3M did not follow up with analyses of human milk to establish the potential implications of this discovery.

In a two-generation study involving rats published by 3M's Dr. Butenhoff and coauthors in 2004, pup weights in the highest dose group were consistently decreased throughout the lactation period [31]. This study also found a slight but statistically significant decrease in lactation index (percent viability from day 5-22 post-partum) for F₁ pups. It is not clear whether these observations were due directly to toxicity from PFCs in the milk, or indirectly via deficient lactation, and such concerns were apparently not of interest to the authors. The transfer of PFCs through maternal milk in animal models was finally recognized by 3M colleagues in a 2005 publication [32].

Accordingly, the recent publications on PFC transfer via human milk [27, 30] do not represent a discovery, but rather a re-discovery of a mechanism identified by 3M much earlier, in 1993, in studies that 3M did not disclose publicly. The relevance of the 3M results on PFC transfer via lactation in goats must be considered in a wider perspective. Due to growing concerns about lactational transfer of dioxins, PCBs, and some pesticides, toxicological studies began to pay attention to this pathway, and in 1976 the World Health Organization began a global monitoring program to measure persistent pollutants in human milk [33]. Since a thorough review handbook on human milk contamination and health risks was published in 1991, the

¹⁸ 3MA00906295, Fluorochemical Projects Underway in the Environmental Laboratory. Page 3MA00906295.

¹⁹ 3MA10037365, PFOS Disposition, custodian Reagen, William K. Page 3MA10037367.